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Notes on a moth, *Eterusia watanabei* (Lepidoptera, Zygaenidae), in Hiroshima Prefecture, Japan

Tsuyoshi TAKEUCHI[1), 2)]*, Hiroshi ENDO[3)] and Mamoru OWADA[4)]

[1)] Center for Ecological Research, Kyoto University, Hirano2-509-3, Otsu, 520-2113 Japan
[2)] Department of Biofunctional Science and Technology, Graduate School of Biosphere Science, Hiroshima University, Kagamiyama, Higashihiroshima, 739-8528 Japan
[3)] Ganjoji281-5, Ikeda, 503-2405 Japan
[4)] Department of Zoology, National Museum of Nature & Science, Amakubo 4-1-1, Tsukuba, 305-0005 Japan

Abstract In Japan, the zygaenid moth *Eterusia watanabei* has been thought to be distributed only in Tsushima Is., Nagasaki Pref. However, sporadic records have been obtained in Wakayama and Hiroshima Pref., suggesting the existence of *E. watanabei* populations in other areas. We have continuously collected *E. watanabei*, including a mating pair of relatively fresh individuals, in Higashihiroshima City, Hiroshima Pref., which indicates that there is an established population there. Interestingly, the habitats of *E. watanabei* on the Japanese mainland are located at higher elevations than those in the Tsushima Is., suggesting that their habitat requirements may differ between small islands and the mainland.

Key words *Eterusia watanabei*, Hiroshima Prefecture, Japan mainland, established population.

Introduction

The zygaenid moth *Eterusia watanabei* Inoue was redescribed by Owada and Horie (1992), based on the characteristics of the copulatory organs of both males and females collected in the Tsushima Is., Nagasaki Pref., Japan. Until then, it had been treated as a subspecies of *E. taiwana* (Inoue, 1982). In the Tsushima Is., adults of *E. watanabei* appear once a year, in June to July, and often visit the flowers of *Castanea crenata* and *Mallotus japonicus* (Owada, 1998). Although the moth is relatively large and conspicuous, many aspects of its life history, such as its detailed annual cycle and larval food plants, are still unknown. In the laboratory, one can rear the larvae by providing them with leaves of *Eurya japonica* (Nishihara, 1995; Owada, 2000).

The moth was thought to be endemic to Tsushima Is. when it was redescribed; however, a male of the moth was collected in Koya Town, Wakayama Pref., Japan in 1995 (Fig. 1; Matoba, 1996), and a male was photographed in Higashihiroshima City, Hiroshima Pref., Japan in 2006 (Fig. 1; Fukunaga and Ueda, 2009). In addition, the moth had been collected in Fujian, Guizhou and Guangxi Provinces, China (Horie *et al.*, 2000), and is also distributed in Guangdong Province, China (Horie and Wang, 2011).

In Koya, there has been no additional record of *E. watanabei* since the first record in 1995. Therefore, one cannot rule out the possibility that the moth in question was a migratory individual, although, like other zygaenid moths, *E. watanabei* seems to be unable to move long distances. In Higashihiroshima, where the second record of *E. watanabei* on the Japanese mainland was obtained in 2006, an additional record has since been obtained: a female was photographed in July 2009 (Fukunaga and Ueda, 2009). However, no specimen was taken. Recently, we collected some specimens of *E. watanabei* in Higashihiroshima. In addition, we obtained eggs from a wild-caught female, and reared the offspring in our laboratory. In this paper, we illustrate the specimens, and report on some ecological aspects of the moth in Higashihiroshima.

Fig. 1. Distrubution of *Eterusia watanabei* in Japan. 1: Tsushima Is., Nagasaki Pref. 2: Higashihiroshima, Hiroshima Pref. 3: Koya, Wakayama Pref.

*Corresponding author. E-mail: takeuchiozephyrus@yahoo.co.jp

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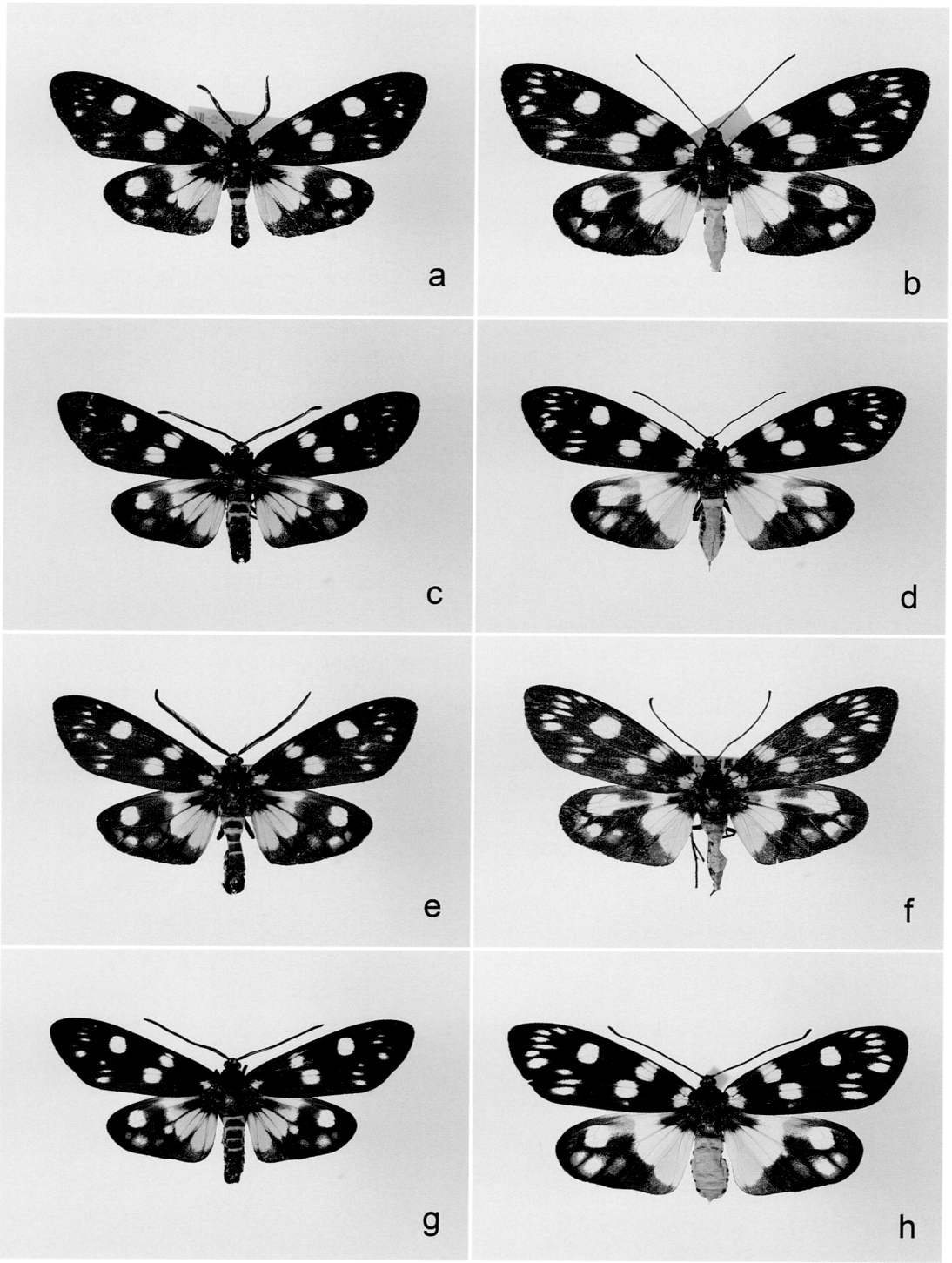

Fig. 2. *Eterusia watanabei.* a: 2 July 2011, Mt. Takanosu Higashihiroshima, male, b: 2 July 2011, Mt. Takanosu Higashihiroshima, female, c: reared Higashihiroshima, male, d: reared Higashihiroshima, female, e: 16–18 June 1991, Waita Toyotama Tsushima Is., male, f: 25–26 June 1999, Toyo Kamitsushima Tsushima Is., female, g: reared Kin Kamitsushima Tsushima Is., male, h: reared Kin Kamitsushima Tsushima Is., female.

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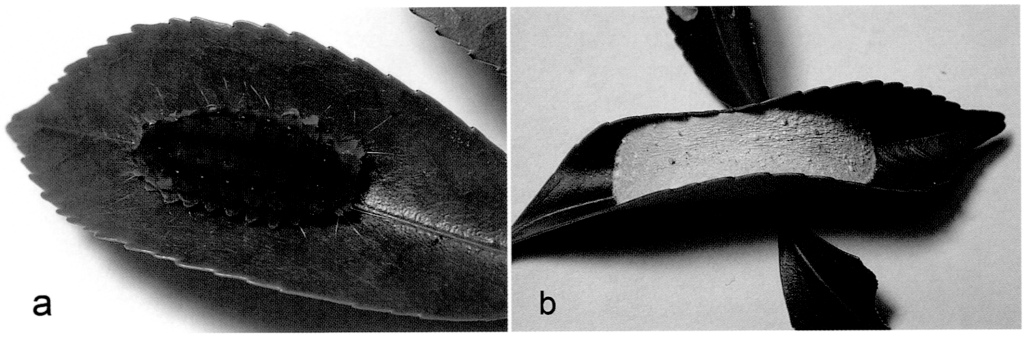

Fig. 3. a: a larvae, b: a cocoon of *Eterusia watanabei* from Higashihiroshima.

Fig. 4. Mating pair of *Eterusia watanabei*. 2 July 2011, Mt. Takanosu Higashihiroshima.

Data and situation of collected moths

1♀, 7 July 2009, Higashihiroshima City. Takeuchi T coll

1♂1♀, 2 July 2011, Mt. Takanosu (*ca*. 700 m *asl*.), Higashihiroshima City. Takeuchi T coll. (Fig. 2a, b).

The female that we collected in 2009 was worn, and visited flowers of *Castanea crenat*a at *ca*. 16:30. In the laboratory, we obtained eggs from the female, and reared the offspring by providing them with leaves of *Eurya japonica* (Fig. 3). Adults emerged from October to November in 2009. One pair of the reared moths is shown in Fig. 2c, d. On 24 June 2011, we revisited the place where we collected the female, but could not find *E. watanabei*: *C. crenata* was not blooming at that time.

The male and female that we collected in 2011 were copulating when caught (Fig. 4). We found flying mating pairs at *ca*. 16:30 and captured them when they alighted on low trees. The habitat was a forest which contained many broad-leaved deciduous trees, such as *Quercus serrata*, *C. crenata*, and some species of genus *Prunus*.

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Discussion

Eterusia watanabei has been continuously seen in Higashihiroshima since 2006. Up to the present time, such continuous sightings have occurred in Japan only in the Tsushima Is. and Higashihiroshima. Since mating individuals were found in 2011 (Fig. 4), it seems beyond doubt that there is an established population of *E. watanabei* in Higashihiroshima.

When Fukunaga and Ueda (2009) reported the first discovery of *E. watanabei* from Higashihiroshima, they did not report the detailed location of the habitat, in order to protect it. Since our specimen obtained in 2009 was collected from very near the site where they found *E. watanabei*, we also are not describing the detailed location of the site. Mt. Takanosu, where we collected the pair of *E. watanabei*, is located in another group of mountains.

Compared to *E. watanabei* in the Tsushima Is., the moths in Higashihiroshima appeared to have smaller white spots on both the fore and hind wings (Fig. 2a–h). This tendency was also recognized in the male and the female photographed in 2006 and 2009 (Fukunaga and Ueda, 2009). However, some individuals from the Tsushima Is. also have white spots of similar size to those of individuals from Higashihiroshima (Owada, personal observation), so that it was not possible to distinguish clearly between *E. watanabei* from Higashihiroshima and Tsushima Is. based on the wing spots.

We think that attention should be paid to the altitude of the location where *E. watanabei* was collected. In Mt. Takanosu, Higashihiroshima, we collected the moths at *ca.* 700 m *asl*. In Koya Wakayama Pref., the moth was collected at *ca.* 800 m *asl*. In the Tsushima Is., the highest ground is 649 m *asl*, and *E. watanabei* was mainly found lower than 200 m *asl*. (Owada, personal observation). Compared to the habitats in the Tsushima Is., the two places on the Japanese mainland where *E. watanabei* was collected are located at relatively high altitudes. Since the life history of *E. watanabei* in nature is largely unknown, it is difficult to interpret this phenomenon. One possibility is that the environment of their habitats differs between small islands and the Japanese mainland. Such cases have been reported in butterflies: some butterflies, including *Araragi enthea*, *Chrysozephyrus ataxus*, *Favonius jezoensis*, *Strymonidia w-album*, live near the seaside and in lowland areas in the Oki Is. Shimane Pref., Japan; however, they live in mountain regions of the nearest part of the Japanese mainland (Kadowaki, 1994).

It is unlikely that in Japan there are established populations of *E. watanabei* only in Tsushima Is. and Higashihiroshima. At least in Western Japan, there are probably many undiscovered habitats of the moth. Further surveys throughout Japan would be required to clarify its distribution. Rediscovery in Wakayama Pref. is also desirable. The moth may be distributed in Korea. We would like to emphasize that in any searches for *E. watanabei*, one should pay close attention to the flowering time of nectar plants, such as *Castanea crenata* and *Mallotus japonicus*, and the elevation at which *E. watanabei* is collected.

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摘　要

広島県のツシマキモンチラシ（鱗翅目, マダラガ科）に関する知見（竹内　剛・遠藤弘志・大和田守）

マダラガ科のツシマキモンチラシ *Eterusia watanabei* は, 長

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崎県対馬には多産するものの，日本国内の他の地域で継続して生息が確認されたことはなかった．広島県東広島市では，2006年に初めて本種が確認されてから，2011年までに合計5個体が確認され，その中には交尾中の雌雄も含まれているので，個体数は少ないものの本種が定着していると考えられる．対馬産と比べると，東広島市産の本種は，前後翅の白点の発達が悪い傾向が見られるが，対馬産にも東広島市産と同程度の個体が混じるため，斑紋だけから完全に区別することはできなかった．東広島市で本種が採集されたのは標高約700 m地点で，他に日本本土唯一の採集記録である和歌山県高野町の1♂は，標高約800 m地点で採集されている．長崎県対馬では海岸線から標高200 m程度で本種が多く見られることと比較すると，本土での採集地点はいずれも高標高である．対馬と本土では，本種の生息環境が異なるのかもしれない．日本における本種の分布が対馬と広島県東広島市に限定されるとは考えにくく，これから各地での生息調査が必要である．

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